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ABSTRACT

The aim of this project was to set up a building that completely fulfilled the educational requirements for a cost-level of semi-permanent (at least 20 years) school buildings. Because of factors that made forecasting the exact future function of this school difficult, and also because building and activities were expected to change continuously, it was decided to construct an experimental building. The building was to (1) have higher educational and functional qualities than the traditional semi-permanent school buildings, (2) be suited for repetition in other parts of the Netherlands, (3) be adaptable to the permanent and changing educational situations; and (4) have the same cost-level as that of traditional semi-permanent buildings. This document describes how the facility was planned in consultation with teachers and pupils to meet structural and educational needs and presents comparative cost aspects. Floor plans and cost analysis tables accompany the text. (Photographs may reproduce poorly.) (Author/MLF)

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Why not a traditional semi-permanent school building?

The aim of this project of the comprehensive school in Lelystad was to set up a building that completely fulfilled the educational requirements for a cost-level of semi-permanent school buildings.
The investigation for the realization of the double aim was found so very important that, in consultation with the Ministry of Education and Science, it was decided to realize this comprehensive school as a development project.
As the school building budget of the Ministry of Education and Science for 1972 and the following years is limited and insufficient to meet the needs, it is necessary to lodge a number of schools in semi-permanent timber buildings.

Semi-permanent means a period of at least 20 years, but because of the possibilities of the building market at this moment, a semi-permanent school building means a traditional school-house with class-rooms, arranged along the corridors, with no possibilities of transformation in the coming years. And this, in turn, means that this kind of school building will in most cases hamper if not prevent the development of education.

The local authority of this comprehensive school asked five contractors of timber schools to submit a design and cost-estimate of a school building. All these designs were based on the traditional class-room system with a corridor and class-rooms on one or both sides. The class-rooms were arbitrarily arranged and not according to subject-groups, house-groups, etc. The circulation area - which in this case meant useless space for the education - was between 25 and 40% of the total superficial area.
However, designing a school building is more than the arrangement of class-rooms, even for a building that, in theory, will last only 20 years. So it is necessary to use as a starting-point whether it is not possible to realize, even with a limited budget, a better educational, functional and technical quality for the school building.

For this particular comprehensive school the standard solution was a problem because:

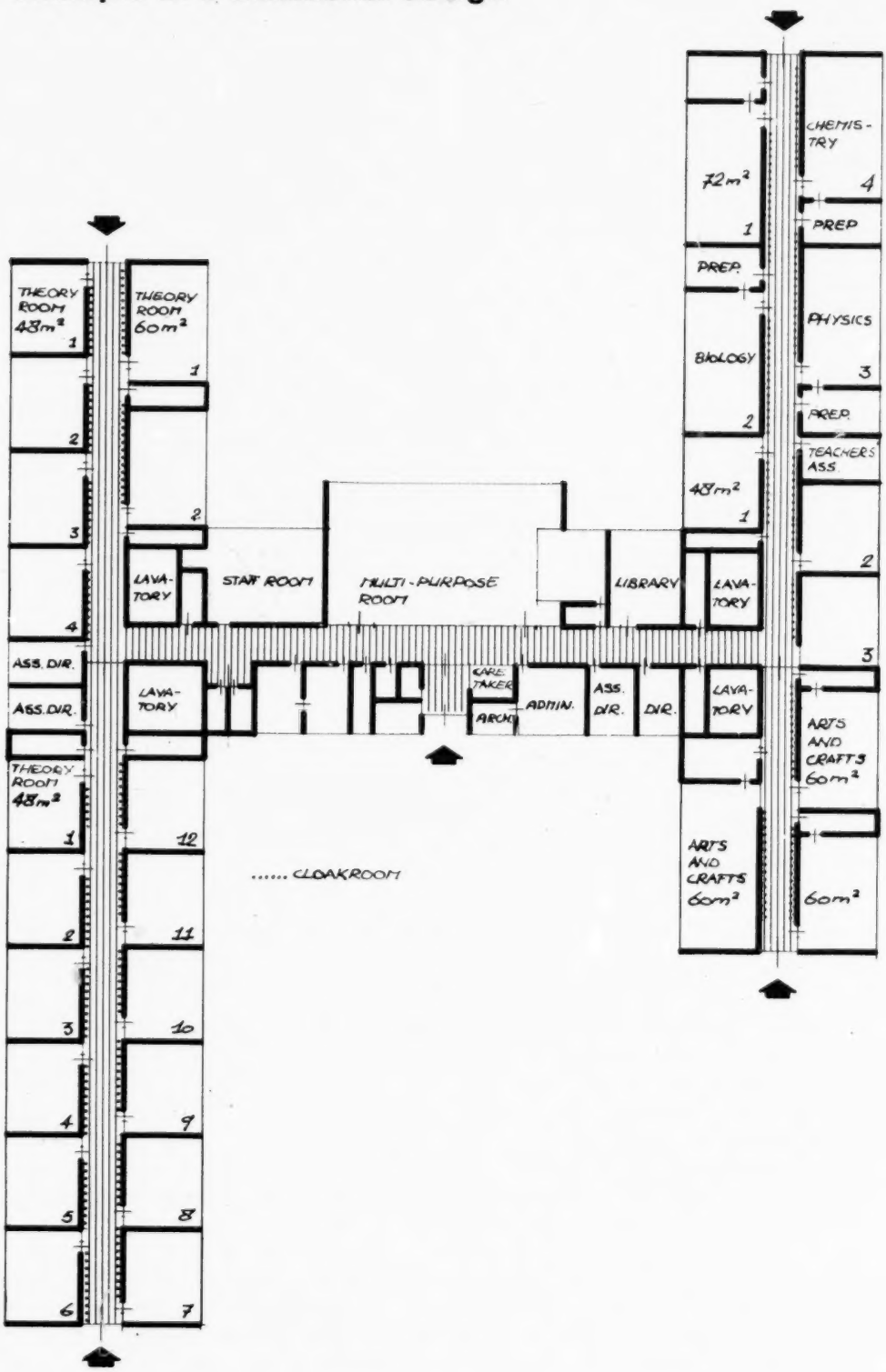
The education in this school was not only already changing from class-teaching into teaching in groups of different sizes, but also the house-group was being introduced in the school.

The school building was designed for 520 pupils and in a couple of years will be part of the total complex of a comprehensive school with between 1,500 and 2,000 pupils.

Moreover, the future of this school will depend on:
- educational development;
- the growth of the population of Lelystad;
- the choice of the pupils between vocational training or general continued education, or pre-university education.

In view of these factors, it was difficult to forecast the exact future function of this school, and undoubtedly the building and the activities in it will change continuously. So in consultation with the Building Department of the Ministry of Education and Science it was decided to construct an experimental building to comply with the

example of a traditional design



following conditions:

The building should have higher educational and functional qualities than the traditional semi-permanent school buildings.

The design should be suited for repetition in other parts of the Netherlands.

The building should in a simple way be adaptable to the permanent and changing educational situations.

The cost-level should be the same as that for traditional semi-permanent buildings.

In January 1972 permission was received from the Ministry of Education and Science to start on the design for the school for 520 pupils. A programme of requirements was drawn up by the Information Centre for School building, which worked as a consultant to the local authority, after which the design was made by the Public Works Department of the "Zuidelijke IJsselmeerpolders".
On April 24, 1972, the contractor started on the construction, and on September 4, 1972, the pupils entered the school.

The preparations and construction were executed in team-work by:

- the Education Department of the Local Authority "Zuidelijke IJsselmeerpolders";
- the Public Works Department of the Local Authority "Zuidelijke IJsselmeerpolders";
- the staff, teachers and pupils of the school.
- the Inspector for secondary education; and
- the Foundation Information Centre for School building in Rotterdam.

This issue of International School building News is being published immediately after the realization of the building, with the aim of giving first information of this development project.

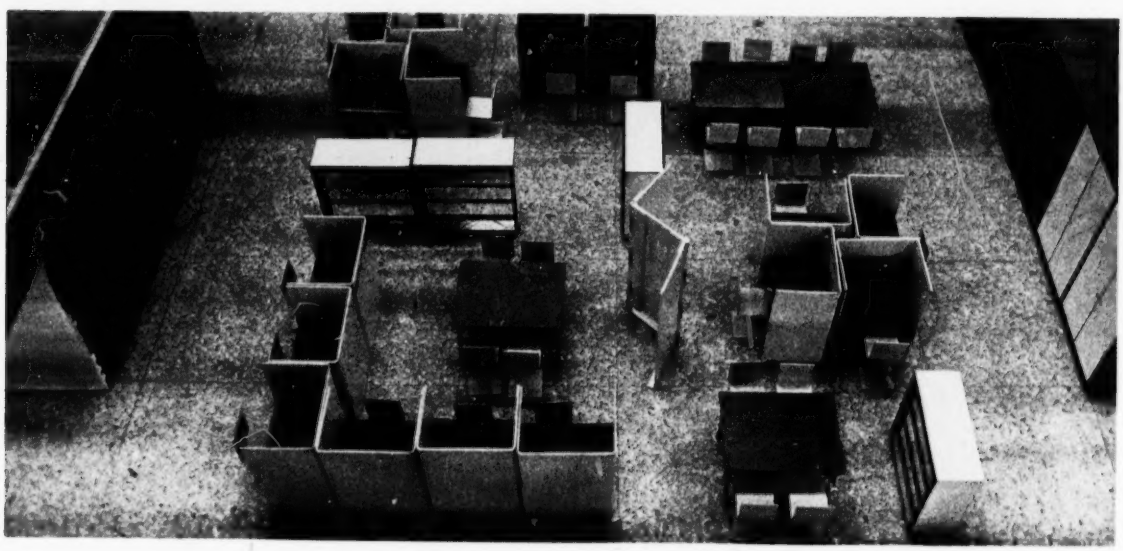
Why consultation with teachers and pupils?

For whom is this school building designed?

Is a school building of this type designed for the pupils or for the adults, or can this be combined?
As architects, as consultants, we take into account that in the designed school building many thousands of children will spend some years of their lives.
Preparation of a school building demands planning, but the planning process for such a building has often become merely a routine: a summing-up of spaces, m2, m3, regulations for ventilation and lighting, and so on.
But education nowadays changes so rapidly that often the school building is already old-fashioned before its construction is finished. One of the most important aspects, "consultation with the future users", is often neglected.

Dynamic change is the only thing we really know about the education of tomorrow. However, it is clear that education is moving in the direction of more individual work, a larger differentiation in the sizes of classes or groups, team-teaching, etc. But examples in other countries have shown that an immediate change from the class-teaching system to teaching in an open school-house usually creates serious problems for all concerned.
Therefore it is very important, that during the stage in which the programme of requirements is being made, the future users are consulted. It is absolutely essential to plan in advance the curriculum and the initial situation in consultation with the future users.

Experience has taught that it is very difficult for most people to have any idea of the space-consequences and architect's design; and this is why the Information Centre for School building has developed a scale model, scale 1 : 20 (see photos), which can be of great help in visualizing the situation.



Scale model: study area.

Scale model: part B.

For example, it greatly simplified the consultation between the future users, the architect and consultants, and in Lelystad this model is often used in the discussion between staff, pupils, local authority, architect, etc.

Investigations in a number of schools have shown that the pupils are often not satisfied with the school building. The materials used are regarded as expensive and not cosy, and the facilities asked for include:

- study possibilities also after the school-hours (home often offers no such possibility);
- discussion corners;
- cosy corners where they can read a paper (every day a new one);
- a multi-purpose room with coffee-bar;
- possibility for playing chess, draughts or other table-games;
- a part of the school where they can reveal their own identity, such as making their own furniture during the handcraft or textile or drawing lessons; and
- a school building that is not so "finished" that it cannot be adjusted or adapted to suit needs or circumstances.

In the preparation of the programme of requirements and the design every effort should be made to meet these wishes as much as possible.

Educational situation

In consultation with the future users the following starting-points for the programme of requirements were adopted:

Type of education

The school is designed for the age-group 12 - 18 years and has the following orientations:
- m.a.v.o. (intermediate general continued education);
- h.a.v.o. (higher general continued education); and
- atheneum (secondary modern).

Integration

In the coming educational situations the class-teaching system will be changed and integration through co-operation will become more important. Integration manifests itself in:
- contact between the subjects;
- contact between the different age-groups;
- contact between the different levels; and
- contact with the community.

Education

The different educational situation in the comprehensive school, as well as the size and structure and composition of the groups, are continuously changing. Difference can be made between:
- instruction lessons to large groups (31 - 80 pupils);
- theory lessons to 21 - 30 pupils or 1 - 20 pupils;
- conversation and discussion groups from 1 - 50 pupils;
- project-work in groups of 1 - 50 pupils; and
- co-operation in small groups of 2 - 6 pupils for team or project-work.

The curriculum is changed to a curriculum for team-teaching whereby the pupils are divided into groups of permanent changing sizes.
In order to obtain the space-consequences from this curriculum, for a number of subjects (languages, social subjects and mathematics) a difference is made between the subjects taught to large groups of pupils through instruction, film, demonstration, etc. and the subjects taught to small groups in the form of language-laboratories, discussions, and special tasks.

On the basis of today's curriculum for each subject a division is made in time between (i) and (p) and there after an analysis is made of how many teacher-lessons are necessary for (i) and (p):

1 - 20 pupils (p)
20 - 30 pupils (p)
31 - 50 pupils (i)
51 - 80 pupils (i)

(p) = project-work, individual study

(i) = instruction

From this new curriculum the number of hours necessary per size of group per subject can be decided, so that the space-requirement can be calculated. The design is so made that both today's curriculum and the curriculum for team-teaching can be realized.

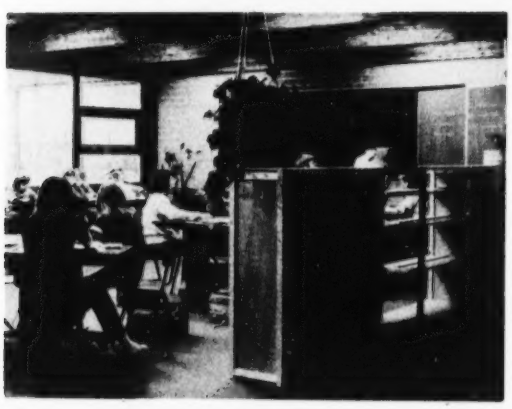
House-groups

Important is the so-called house-group, a group of about 50 pupils of different ages with the following activities:
- project-work;
- discussion;

- conversation;
- tasks and studies;
- meals and drinking coffee; and
- festivities.

These house-groups form a vertical organization and can possibly be the solution of the increasing problem of massality in the comprehensive schools, because by the increasing differentiation and the working in different level-groups which has changed the traditional class-teaching structure, the danger exists that the pupils are lost in the mass of 500, 1,500 or 2,000 pupils.
The house-group forms a unit which works part of the day together on the above-mentioned activities, the remaining hours being filled in with other group situations with instruction, theory or laboratory or study-lessons.
Every house-group has one or two teachers acting in the capacity of mentor.

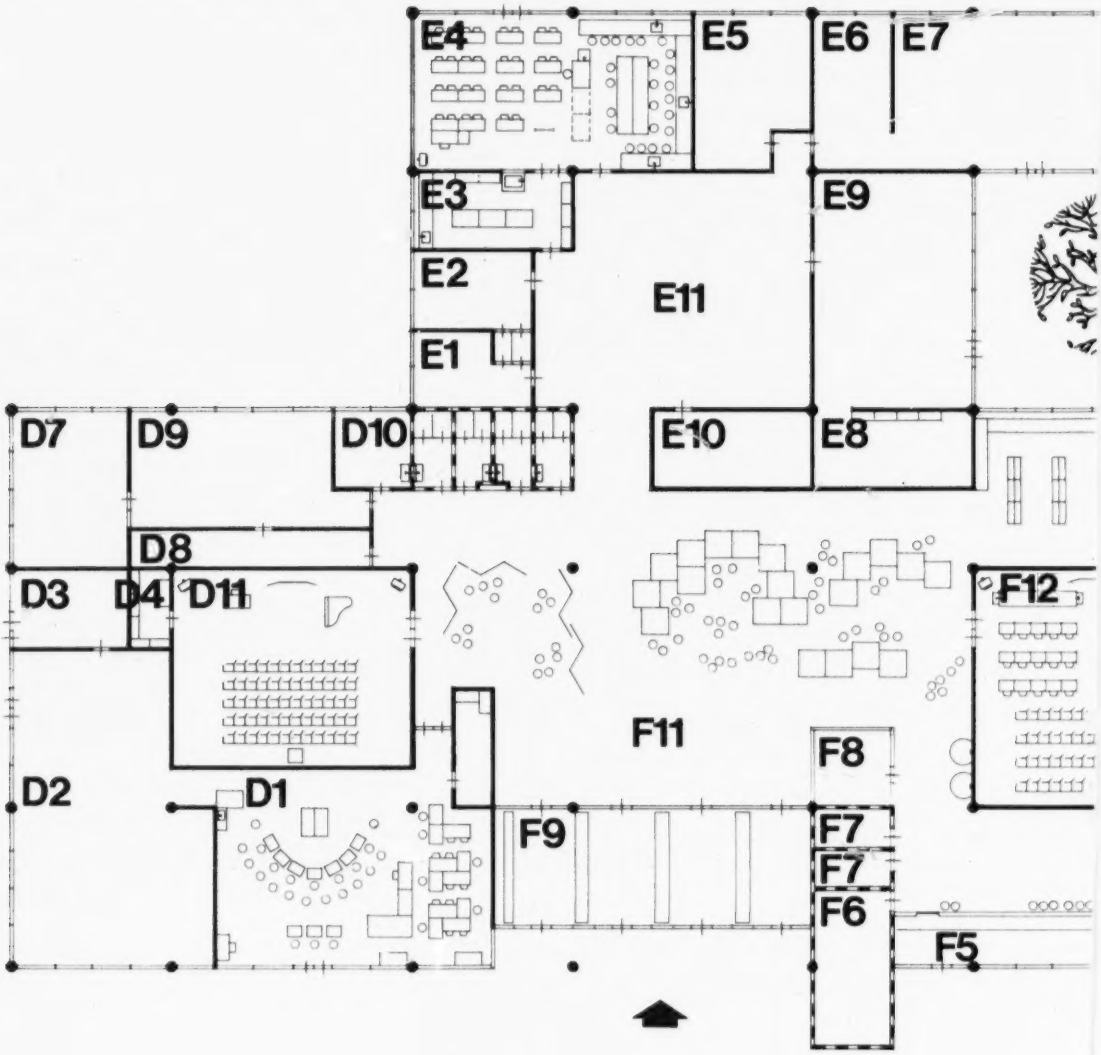
The open "class-room"



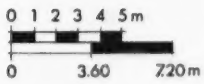
plan

A 1	general subjects room open	B 1	general subjects room open	C 1	general subjects room open
A 2	teachers' workroom	B 2	teachers' workroom	C 2	language laboratory
A 3	geography	B 3	general subjects room closed	C 3	teachers' workroom
A 4	general subjects room open	B 4	general subjects room open	C 4	general subjects room open
A 5	teachers' workroom	B 5	teachers' workroom	C 5	general subjects room close
A 6	general subjects room closed	B 6	language laboratory	C 6	teachers' workroom
A 7	general subjects room open	B 7	general subjects room open	C 7	general subjects room open
A 11	study area	B 11	study area	C 11	study area

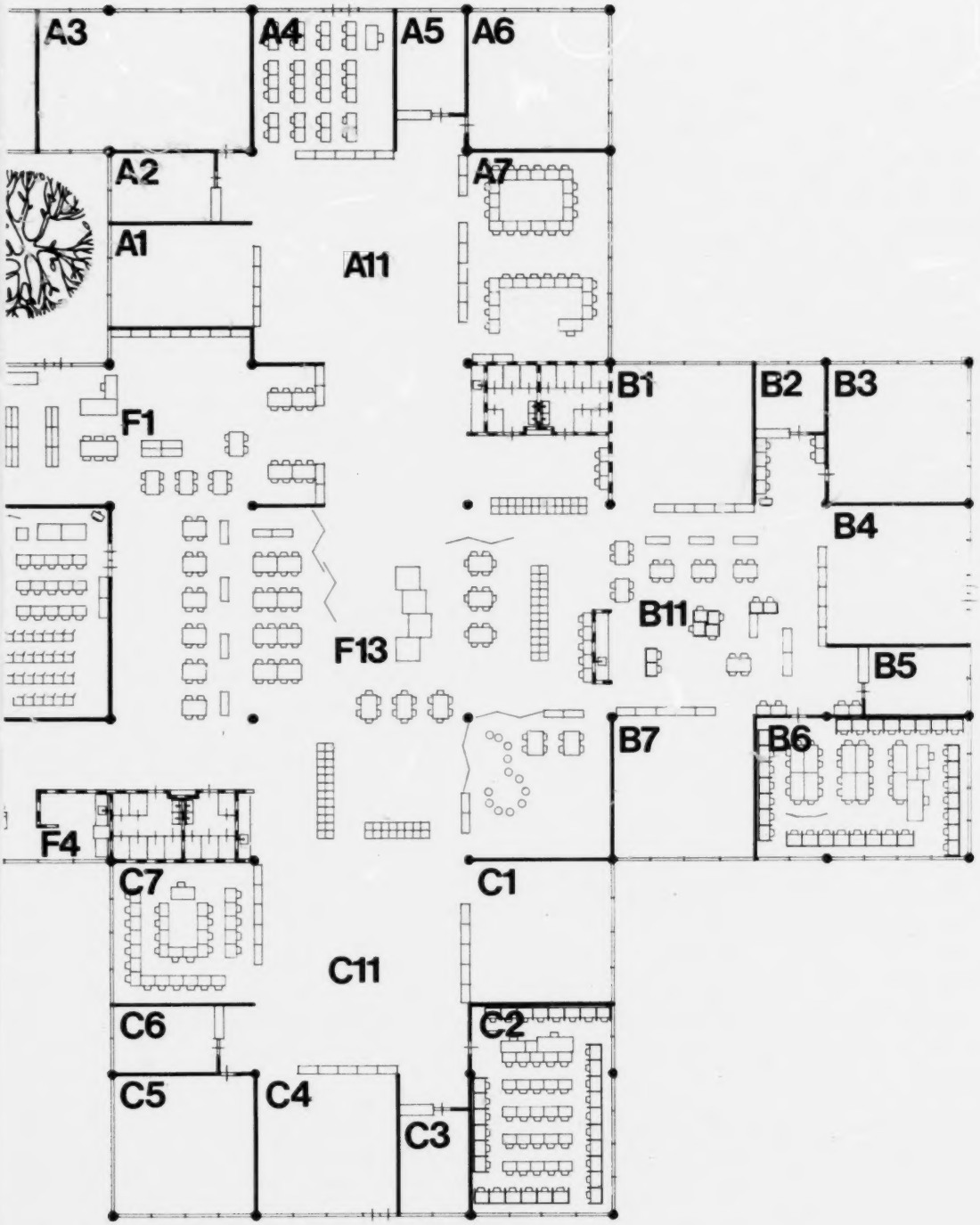
brick walls flexible partitions



plan



D 1	arts and crafts centre	E 1	school medical officer	F 1	library
D 2	arts and crafts centre	E 2	nurse room	F 4	kitchen
D 3	storage	E 3	preparation chemistry	F 5	coffee bar
D 4	storage	E 4	theory/laboratory chemistry	F 6	central heating
D 7	director	E 5	teachers' assistant	F 7	technical installations
D 8	archives	E 6	preparation physics	F 8	caretaker
D 9	administration	E 7	theory/laboratory physics	F 9	cloakroom
D 10	cleaners' room	E 8	preparation biology	F 11	multi - purpose room/social area
D 11	music/instruction	E 9	biology	F 12	instruction large groups
		E 10	audio visual centre/dark room	F 13	multi - purpose room/study
		E 11	study area		



Why a programme of requirements?

Although it was not possible to comply fully with the educational situation outlined in the brief of the Ministry of Education and Science (and summarized in Chapter 2), the lump-sum method opened the possibility of taking into account the cost-level and thus changing that brief into another programme of requirements. Working in co-operation with the team partners a programme was developed which came within the total surface and the cost-limits, and also met the requirements of this school.

The superficial area has been sub-divided in a completely different way, whereby a better division between the educational area and the non-educational area is obtained by:

- a multi-functional use of a part of the educational area;
- a limitation of the circulation area; and
- a good situation of the different subject-groups.

Flexibility

One of the aims was that the building should be in a simple way adaptable to the permanent changing educational situations. For this project this general requirement of flexibility has been worked out as follows:

The school building is suited for today's teaching methods, as required by the teachers.

Because today's education in this building is no longer the traditional system but, on the other hand, is still in an experimental phase, a reversion must be possible. If this experiment is not a success, it must be possible to go back to the traditional class-teaching method, with each teacher in his own box.

The building must be suited for future developments in education, such as other teaching methods, etc.

Functional diagram

In the functional diagram (see page 17) the main relations between the subject-groups and the general purpose areas are indicated. In this diagram also can be seen how the house-groups are placed in the general subject-units. The four house-groups form "one unit".

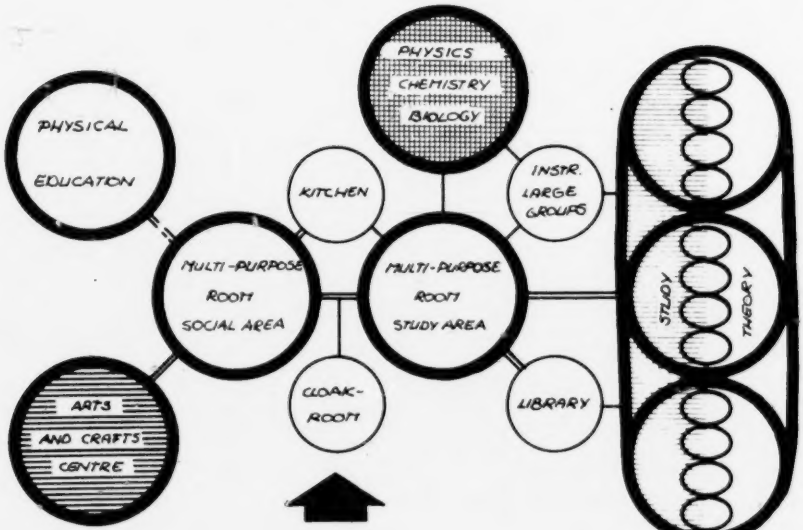
Surface analysis

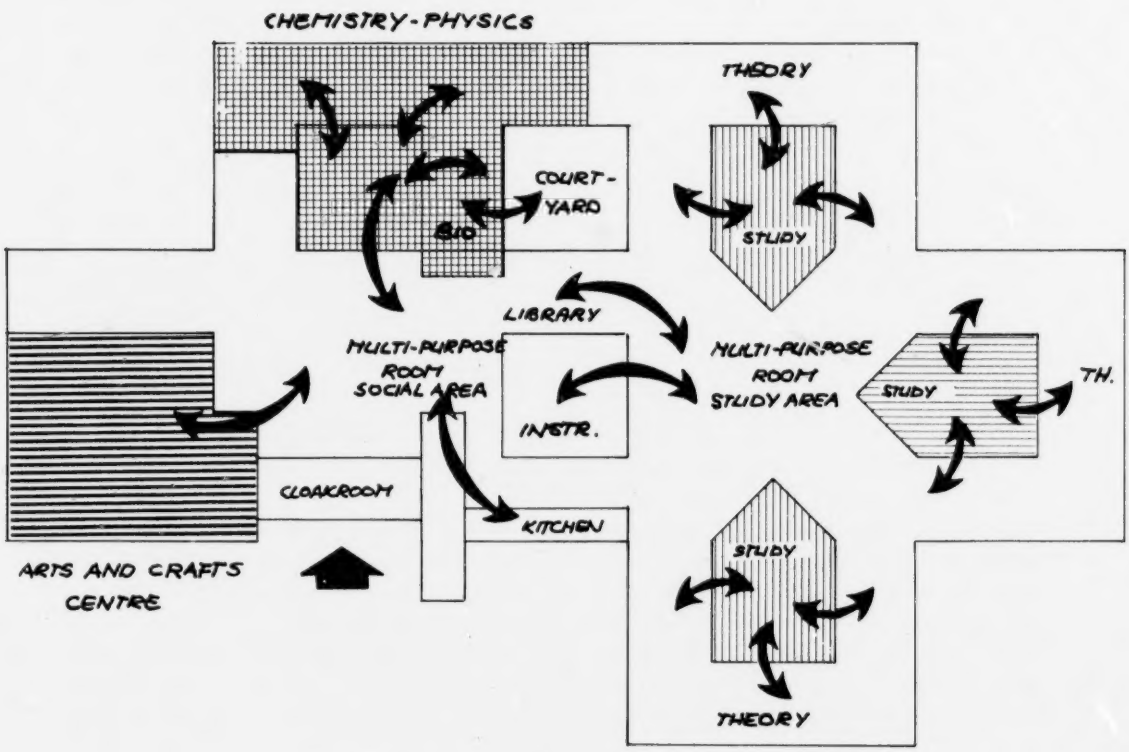
The educational requirements mentioned in the previous chapter form the basis for the surface calculation, some of the specific points being:

House - groups

The house-groups form an important element in this school. It is necessary that each group has its own house, that is, a fixed place in the school for

relations educational and additional areas





meeting, discussion, announcements, etc. In each house-group each pupil has a small place for keeping books, paper, etc. When at the same moment all the house-groups are together, the total area necessary is 520 x 2 = 1,040 m2. Within the present regulations of the Ministry of Education and Science this is impossible, unless some of the areas are used in a multi-functional way.

Educational areas

Depending on the activities, the sizes of the educational areas vary. They are divided into three main groups:
- closed areas, visually and acoustically isolated from other spaces;
- open educational areas, in direct relation to, for instance, the study areas; and
- areas for project-work and group-work.

The closed rooms are used as:
- instruction area for large groups;
- theory and laboratory for biology, physics and chemistry;
- music;
- arts and crafts centre; and
- some general purpose class-rooms.

The open educational areas are partly used for instruction, though most of the time they are used in relation with the study areas where the pupils work in small groups. Per general subject area there are three open and two closed class-rooms.
The study areas are used for individual study, discussion, project-work and the house-groups.
The study areas are so dimensioned that 1/6 of the pupils (24 – 30 pupils per general subject-unit) is working individually. For this purpose a surface of 60 m2 is required.

Multi-purpose room

The multi-purpose room has the following closely-related functions:

- social function	: informal contact between pupils, parents and teachers;
- cultural function	: drama, music, expositions;
- educational function	: study, individual work, group-work, project-work;
- information function	: expositions, vocational guidance; and
- complementary function	: during free hours between the lessons, coffee-breaks and for meals.

The multi-purpose room is divided to function in two parts. One has a mainly educational function as a quiet room in relation to the library and study areas. The other is destined for complementary and social functions, in relation to the coffee-bar, the kitchen and the arts and crafts centre.
Each part can be used separately. For lectures, drama and activities after school-hours, the multi-purpose room can be merged with the study areas to form one open space of 700 m2. This means that the whole school-population can meet together.

The multi-purpose room.

Summing-up

When all the requirements mentioned in this chapter are taken together, it becomes evident that it is possible to realize these requirements, when a multi-functional use is made of the different spaces.

Circulation areas

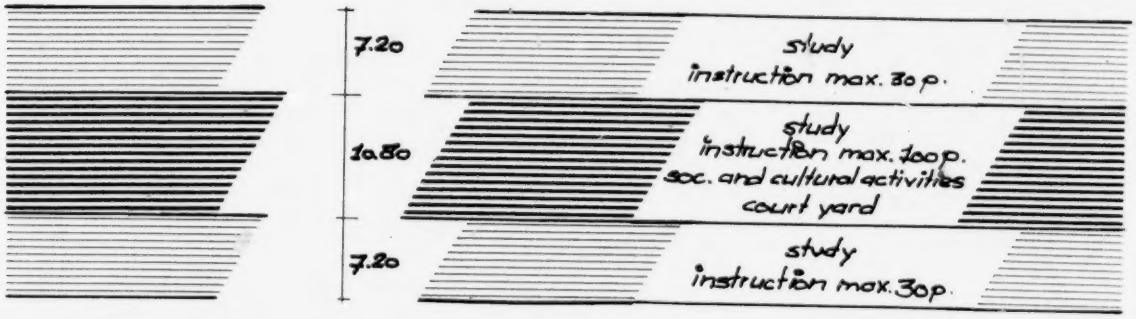
The circulation area is reduced to less than 8% of the net surface; the multi-purpose room and the study areas are also used for circulation purposes. On a traditional school-house, the percentage of the circulation area is between 25 and 40%.

Design system

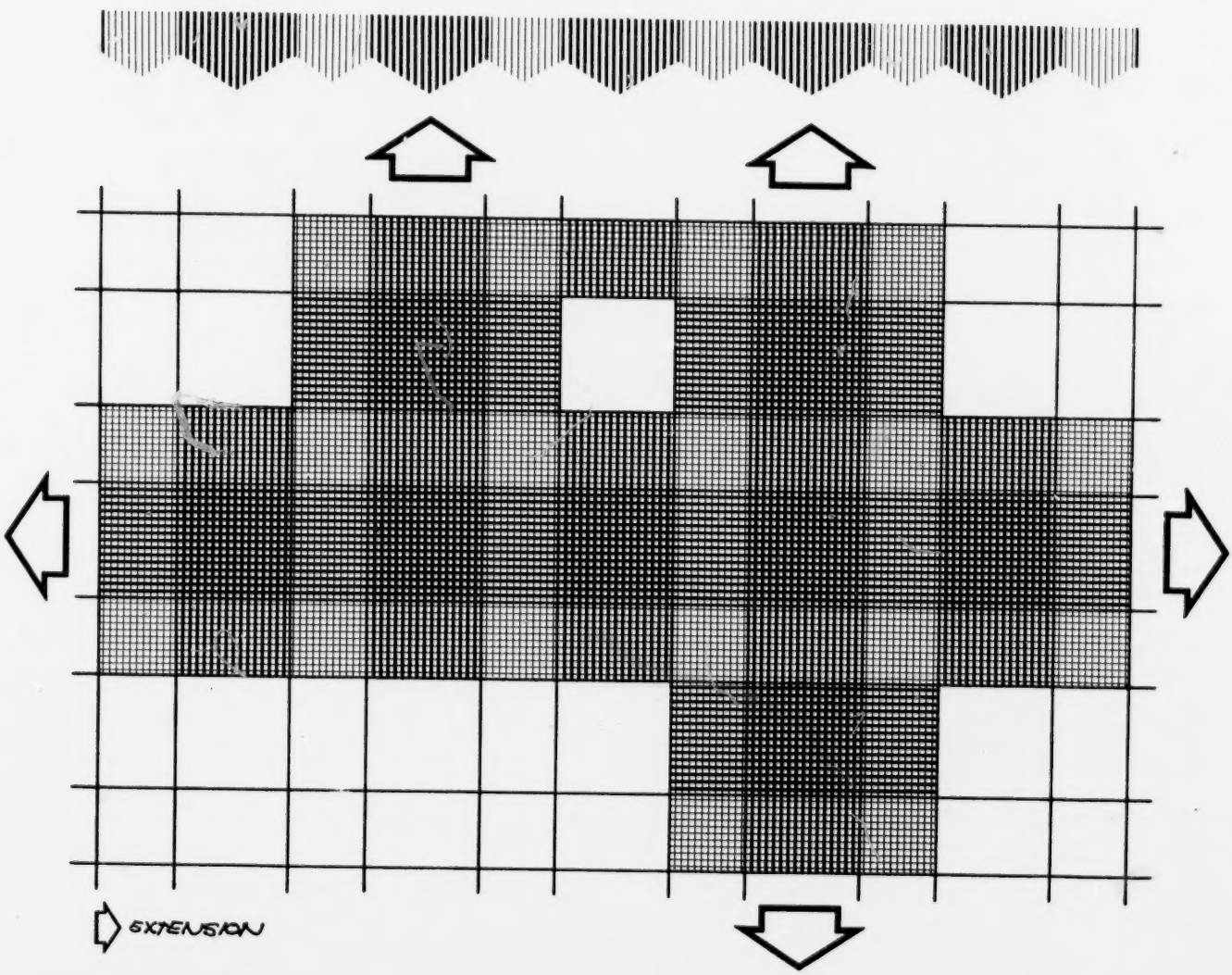
For the design of large and small educational areas, a design grid of 1.80 m was chosen. The construction grid for the positioning of the columns is alternative: 7.20 m and 10.80 m to give the following combination possibilities:

7.20 x 7.20 m = general subject class-rooms;
7.20 x 10.80 m = general subjects, laboratories or large general subject areas; and
10.80 x 10.80 m = multi-purpose room, instruction room and study area.

design system



design grid



Why not a multi-storey building?

In order to see the consequences of a multi-storey building in the first design stage, two alternative designs were made for this school building, based on the same programme of requirements. One was a purely ground-floor design, and the other had two storeys. The designs were then compared in relation to:

- the educational aspects;
- the building aspects; and
- the cost aspects.

The educational aspects

By dividing the plan over two storeys with an open relation between the educational areas and other areas, the multi-functional use is reduced. For the exact science subjects and the arts and crafts rooms a location on the ground-floor is necessary, while for the general subjects a location on the ground-floor or on the first floor is less important.
Since the total area for the general subjects, including the study area, is larger than the area for the arts and crafts centre and the science subjects, some of the general subject rooms are situated on the ground-floor and some on the first floor. However, the staircases form a bottleneck in quick circulation during the changes of the lessons, since the walking-speed on the stairs is half the normal speed.

By situating the library on the first floor the relation between the library and one of the general subject-groups is more difficult. The general subject-units as well as the units for the science and the arts and crafts are, as far as the division and sub-division are concerned, the same in both designs. The difference between them is more specific in the multi-purpose rooms, the study areas and in the relation of the units.

Building aspects

The design grid is the same in both designs, but there are differences in materials:

Foundation

The foundation is larger in the ground-floor design than in the design in two storeys. Fewer piles are necessary in the second design, but of larger dimension.

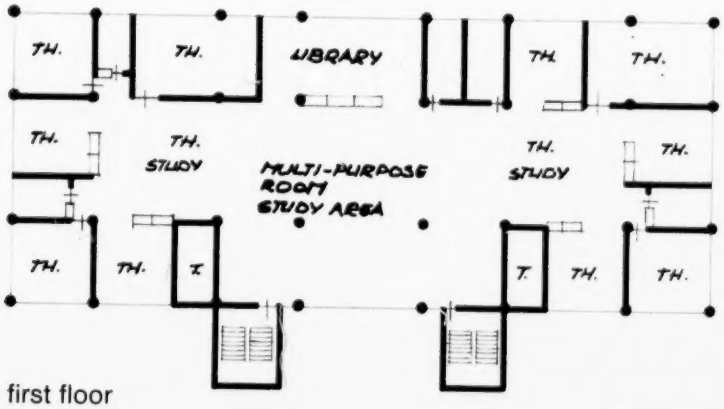
Columns and beams

In the design on the ground-floor timber columns and beams are possible, while in the two-storey version concrete columns and beams are necessary.

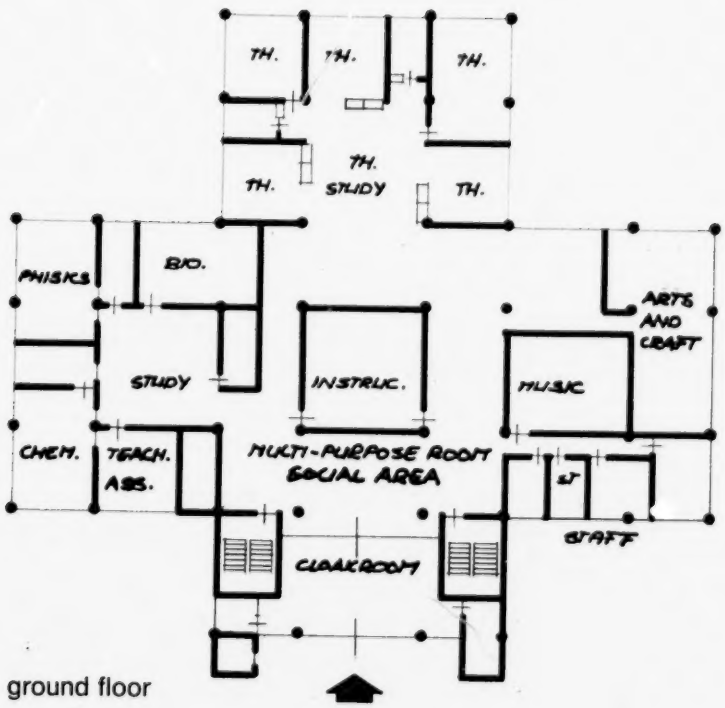
Floors

Light-weight concrete elements in the design on the ground-floor, while in the multi-storey design there are light-weight concrete elements on the ground-floor and a concrete cast in situ for sound-isolation on the upper-floor.

alternative design in two storeys



first floor



ground floor

Staircases

This was an extra element in the design in more than one floor.

Ventilation

In the design on the ground-floor the rooms situated in the middle of the building, as the instruction room, the multi-purpose room and the study areas, can be ventilated in a simple way through the roof. In a multi-storey building a more difficult system of ventilation is necessary for the ground-floor.

Height of the rooms

For acoustic, esthetic lighting, ventilating and heating reasons a low ceiling is necessary.

For both designs a cost-plan was made.

Costs aspects

Due to the low cost of the ground (ƒ 12.50/m2) there was no objection at this point to building only a ground-floor school. A comparison of the two cost-plans from the two designers resulted in the design in two storeys being ƒ 32,000 cheaper, but the construction time was about two months longer.

Conclusion

It is possible to build the school either on the ground-floor or in two storeys, based on the same programme of requirements.

In educational and functional aspects, there are some disadvantages in the design in two storeys.

The building costs are a little lower for the design of two than for the design on the ground-floor.

The building time for the design in two storeys is about two months longer.

Taking all these factors into consideration, the design on the ground-floor was finally chosen.

Why not economize on the finishing materials?

The cost-level is known at the beginning of the design stage, but the level given by the Ministry of Education and Science was both sharply calculated and fixed.
The first reliable cost calculation is usually made when the design, which often takes a year or longer to work out, is finished. When the architect's or contractor's calculation is higher than the cost-level given by the Ministry of Education and Science, normally it is not the design that is changed but economy is practised on the finishing materials. Yet it is these materials which influence every day, every hour, the acoustics, the behaviour and the "livability" of the building.

From the very start of this school building, the finishing-level has not been changed. To obtain the necessary flexibility, all the walls are removable, with the exception of the sanitary-units. Blackboards and pin-up boards are part of these walls and can be changed according to requirements.
In the teachers'working room the cupboards are also placed in these removable partitions.
In comparing the cost of these walls and of brick walls, for instance, it is necessary to take into account that with these finishing materials normally an amount of about f 20,000 would be spent on the blackboards, pin-up boards and cupboards which in this school form a part of the movable partitions.

Extra attention was paid to the sound-isolation, because there are only cupboards 1.50 m high as the visible separation between the open class-rooms and the study areas.
With the exception of the unit for exact science and the arts and crafts centre, carpet was laid all over the school, with different types of carpet being used in the three general subject-units.
In the spring of 1973 a study will be carried out to compare maintenance (durability, comfort and cleaning possibilities), acoustic and functional qualities.

In order not to reduce the flexibility there are no electric switches or points on the walls, while both the lighting system and the heating system are independent of the division into rooms. For the heating the choice was made of a floor-heating system combined with induction-units to control the temperature in the rooms with external windows.

The contractors and sub-contractors for the project were:

main contractor	- H. Moes N.V., Zwolle
timber framework	- Dracon B.V., Nieuw Amsterdam
heating and ventilation	- Verkaart, The Hague
electrical installations	- Bureau Koldijk N.V., Kampen
movable partitions	- Interwand B.V., Eindhoven

Why not more expensive?

A cost-analysis of this project accompanies this summary, and merits careful study, especially as the question arises on how far this building is still semi-permanent in view of the fact that it has concrete foundations and concrete floors, hardwood external window-frames, central floor-heating with mechanical ventilation, removable internal partitions and carpets on the floors.

The costs of a traditional wood school vary between ƒ 100 and ƒ 150 per m3. For this project the cost was about ƒ 130 per m3, although without the inclusion of the experimental cost, the price would have been ƒ 112 per m3.

Although the finishing-level is high, the building cost is low. This low level, however, was not obtained by economizing on the finishing materials but by standardization of the building elements and a consequent special design on the design grid. The result has been that at a low cost a better educational quality has been realized, along with a greater educational area and a building which can be adapted in a simple way to new educational situations.

When it is realized that a first prototype is always more expensive than the series product, it is evident that with this project a better quality has been obtained at a lower price - a satisfactory and hopeful result in these days when school building budgets are limited.

The open "class-room"

Cost analysis

		amount	per m2	per m3
1.0.	FOUNDATIONS			
1.1.	EXCAVATIONS (2,800 m3)	f 7,910	f 2.03	f 0.55
1.2.	PILE FOUNDATIONS (355 piles)	f 59,136.50	f 15.16	f 4.11
1.3.	FOUNDATIONS			
	a. concrete (250 m3)	f 82,305	f 21.10	f 5.72
	b. lime-sand bricks (7,900)	f 2,347.50	f 0.60	f 0.16
1.4.	FLOOR concrete floor elements	f 113,100	f 29	f 7.87
	TOTAL 1.	f 264,799	f 67.89	f 18.41
2.0.	CONSTRUCTION			
2.1.	WOOD CONSTRUCTION columns and beams	f 405,500	f 103.97	f 28.21
2.2.	ROOF timber joists supported on main beams with wood-wool-cement slabs (7.5 cm) covered with 3 layers tarred felt and gravel	f 134,557	f 34.50	f 9.36
2.3.	EXTERNAL (3,165 blocks)	f 1,957	f 0.50	f 0.13
2.4.	EXTERNAL WINDOWS AND DOORS	f 116,907	f 29.97	f 8.13
2.5.	PARTITIONS			
	- for toilet-units (MB1-stone)	f 6,930.75	f 1.78	f 0.48
	- doors, etc.	f 14,886.75	f 3.82	f 1.03
	TOTAL 2.	f 680,738.50	f 174.54	f 47.34
3.0.	FINISHES			
3.1.	WALL-FINISHES wall-tiles (15 x 15)	f 20,250	f 5.19	f 1.40
3.2.	FLOOR-FINISHES carpet, linoleum in science rooms, rubber in arts and crafts centre	f 66,318.25	f 17	f 4.61
3.3.	CEILING-FINISHES removable ceilings of redwood	f 8,850	f 2.27	f 0.61

		amount	per m2	per m3
3.4.	INTERWAND FLEXIBLE PARTITIONS (1,397 m2), including blackboards and pin-up boards	f 142,500	f 36.54	f 9.91
	TOTAL 3.	f 237,918.25	f 61	f 16.53
4.0.	INSTALLATIONS			
4.1.	SANITARY INSTALLATIONS			
4.2.	KITCHEN	f 46,428	f 11.90	f 3.23
4.3.	WASTE AND RAINWATER PIPES			
4.4.	COLD AND HOT WATER SERVICES			
4.5.	HEATING	f 207,650	f 53.24	f 14.45
4.6.	ELECTRICAL SERVICES	f 103,000	f 26.41	f 7.16
4.7.	CO-ORDINATION CONTRACTOR	f 10,000	f 2.56	f 0.69
	TOTAL 4.	f 367,078	f 94.11	f 25.53
5.0.	GENERAL COSTS			
5.1.	STAFF CONTRACTOR	f 15,612	f 4	f 1.08
5.2.	PRELIMANARIES	f 38,962	f 9.99	f 2.71
5.3.	SITE PREPARATION			
	TOTAL 5.	f 54,574	f 13.90	f 3.79
6.1.	OVERHEADS	f 34,416.50	f 8.82	f 2.39
6.2.	PROFITS	f 24,355.75	f 6.25	f 1.69
	TOTAL 6.	f 58,722.25	f 15.07	f 4.08
TOTAL 1 - 6		f 1,663,880	f 426.60	f 115.68
Value Added Tax (14%)		f 232,943	f 59.72	f 16.20
GRAND TOTAL		f 1,896,823	f 486.32	f 131.88
GRAND TOTAL without experimental costs		f 1,613,007.40	f 413.55	f 112.13

Surface analysis

	net surface in m2	total net surface in m2	surface/ pupil in m2
1. EDUCATIONAL AREAS			
general subjects room - small	1 x 40	40	
general subjects room - normal	10 x 50	500	
general subjects room - large	4 x 77	308	
instruction large groups		116	
music/instruction		96	
theory/laboratory physics		77	
theory/laboratory chemistry		89	
biology		77	
arts and crafts centre (drawing, etc.)		110	
arts and crafts centre (woodcraft, etc.)		110	
		1,523	2.9
2. STUDY/SOCIAL AREAS			
study area	4	500	
library		160	
multi-purpose room - social area	1 x 300		
multi-purpose room - study	1 x 500	800	
		1,460	2.8
3. ADDITIONAL AREAS			
storage		15	
preparation room	3 x 18	54	
storage arts and crafts centre		18	
storage - archives		19	
audio visual centre/dark room		18	
director		38	
administration		47	
caretaker		12	
teachers' workroom	6 x 18	108	
kitchen including storage		50	
central heating		24	
technical installations	2 x 6	12	
cleaners' room		12	
school medical officer		18	
nurse room		20	
toilets	3 x 25	75	
cloak-room	1	74	
teachers' assistant		36	
		650	1.25
4. CIRCULATION AREA		100	
TOTAL		3,733	
walls + construction		167	
GRAND TOTAL		3,950	7.5